

Natural Gas Vehicle (NGV) Facts

What are the major advantages of natural gas as a transportation fuel?

Economics

- ◆ Natural gas costs an average of 15 to 50 percent less than gasoline per gallon equivalent.
- ◆ Natural gas is a clean burning fuel that reduces vehicle maintenance. Many users report that oil changes are needed only every 10,000-20,000 miles. Standard spark plugs last as long as 75,000 miles.
- ◆ Natural gas, unlike liquid fuels, cannot be siphoned from a vehicle. Fuel theft is an on-going concern of fleet managers.

Environmental

- ◆ Natural gas is the cleanest burning alternative fuel. Compared with gasoline powered vehicles, NGVs can reduce exhaust emissions of carbon monoxide by approximately 69 percent, non-methane organic gas by 87 percent, and oxides of nitrogen by 87 percent. In addition to these reductions in pollutants, NGVs emit significantly less greenhouse gases than gasoline vehicles.
- ◆ Dedicated NGVs (bought directly from automakers) have little or no evaporative emissions or emissions during fueling. In gasoline vehicles, evaporative and fueling emission account for at least 50 percent of a vehicle's total hydrocarbon emissions. Dedicated NGVs also can reduce carbon dioxide exhaust emissions by almost 20 percent.
- ◆ Exposure to the levels of suspended fine particulate matter found in many U.S. cities has been proven to increase the risk of respiratory illness. Diesel exhaust is under review as a hazardous air pollutant. Natural gas engines produce only tiny amounts of this particulate.

Job Creation

- ◆ According to a National Defense Council Foundation report, in order to meet the projected demand for natural gas vehicles and fueling stations (created by government requirements and environmental concerns), a substantial investment would have to be made. The direct investment in vehicle fabrication, fueling station, and infrastructure construction, and in vehicle and station maintenance will result in the creation of 13,500 jobs during the first phase of the market's development (1996-2000). Indirect investment will stimulate the creation of another 30,000 jobs for a total of 43,500 jobs by the year 2000. Over the first five-year period, gas producers will pay approximately \$16.8 million in state severance taxes on gas produced to service the NGV market. In addition, \$30 million in royalties will be generated, with at least \$9 million flowing into the Federal treasury.

Domestic Abundance

- ◆ Natural gas is a domestic, readily available fuel. According to the U.S. Department of Energy, a 65 year supply of natural gas is available in the U.S. using existing technology.

- ◆ Nearly 100 percent of all natural gas used in the United States is produced in North America. Nearly 90 percent is produced in the United States and the remainder in Canada. If traditional and non-traditional technologies are used, a 200-year supply is projected.

Safety

- ◆ Compressed natural gas fuel cylinders are much thicker and sturdier than standard gasoline tanks, which are made of thin sheet metal. Cylinders are composite aluminum, carbon fiber, or steel, and withstand severe abuse testing.
- ◆ A 1987 survey of utility-operated NGV fleets found that in 434 million vehicle miles, while incurring collision rates equal to gasoline vehicles, NGV injury rates per 100 million miles traveled were 84 percent less than those of gasoline vehicles.
- ◆ NGVs use the same energy that has safely and comfortably heated homes and cooked meals for more than 100 years.

Where are NGVs used now?

- ◆ In the United States, almost 60,000 NGVs are on the road today. NGVs have a long-established record in Europe, Canada, New Zealand, and Australia as well. Italy has been using natural gas as a vehicular fuel since the 1940s, with more than 250,000 NGVs. New Zealand has 75,000 NGVs, which is 20 percent of all their vehicles. In Canada 30,000 NGVs operate with a network of 125 public refueling stations. Argentina has 285,000 NGVs, and Russia has more than 300,000, with plans to convert 1 million vehicles throughout this decade. Worldwide, over 1 million NGVs are in use.

How are NGVs refueled?

- ◆ Vehicles can be “fast filled” in 5 to 6 minutes using compressed gas stored in cascades of natural gas cylinders or refueled on a “slow fill” basis in about 5 to 8 hours. Many refueling stations use a combination of fast fill and slow fill.

What is a bi-fuel vehicle?

- ◆ A bi-fuel vehicle can run on either natural gas or gasoline. Many are designed to switch automatically to gasoline when natural gas reaches empty. These vehicles get the same or slightly less miles per equivalent gallon of natural gas as gasoline.

How much do NGVs cost?

- ◆ The cost to convert a vehicle to run on natural gas ranges from \$3,000 to \$5,000. Conversions for larger vehicles such as trucks and school buses cost more. The equipment can be transferred to another vehicle and revised on a new, similar type of vehicle. Life cycle costs, particularly on a second vehicle, become very attractive.
- ◆ Dedicated NGVs cost \$3,500 to \$7,000 more than gasoline vehicles. As more vehicles are sold, economies of scale will lower the price. The Department of Energy estimates that NGVs will cost approximately \$800 more when mass-produced.

Where can an NGV be refueled with natural gas?

- ◆ A growing number of public refueling stations are available across the country. More than 1,100 natural gas refueling stations operate in 46 states and the District of Columbia, and more than half of these are open or available to the public. Oil companies such as Amoco, UNOCAL, and Shell are involved in programs to develop more public fueling stations. Many utilities provide compressor station equipment or compressed natural gas to customers.
- ◆ NGVs can be refueled by a small dispenser directly connected to a home's natural gas line.

What about the vehicle's power?

- ◆ Gasoline vehicles converted to natural gas are subject to a small power loss when running on natural gas, however, vehicles designed specifically to run on natural gas will have minimal or no loss of power and may even have greater power and efficiency, when taking advantage of the higher octane rating of natural gas.

What dedicated NGVs are being manufactured now?

- ◆ All major car, truck, and bus manufacturers have built dedicated prototype NGVs. Many NGVs are directly available from the original equipment manufacturers. Ford sells dedicated Crown Victoria sedans, E-series vans, and F-series pick up trucks. Ford also produces bi-fuel Contours. Chrysler has manufactured natural gas B-vans and mini vans. Honda plans to mass produce its natural gas Civic in 1998.
- ◆ Flexible Bus Company and the Bus Industries of America both are selling buses designed to run on natural gas. Major diesel engine manufacturers, such as Caterpillar, Cummins, Detroit Diesel, Hercules Engine, and Navistar, are developing or producing heavy duty natural gas engines for a wide variety of vehicle applications. Thirty-nine manufacturers produce more than 90 varieties of natural gas vehicles, engines, and chassis, varying from light duty passenger vehicles to school buses and fork lifts.

Can current NGV technology keep pace with the advances in the auto industry?

- ◆ Recent advances in NGV technology will keep the industry on track with the most advanced technologies being produced by the major automotive manufacturers.
- ◆ NGVs are compatible with throttle body and multiport fuel injected engines. Closed loop, computer compatible conversion kits are now being developed and marketed. These will improve NGV bi-fuel vehicle performances and optimize emissions reduction.

How do NGVs work?

- ◆ The only major difference between a gasoline vehicle and an NGV is the fuel system. Natural gas is compressed to 3,000 pounds per square inch and is stored on board the vehicle in

cylinders installed in the rear, undercarriage, or atop the vehicle. When natural gas is required by the engine, it leaves the cylinders, passes through a master manual shut-off valve and travels through a high pressure fuel regulator located in the engine compartment. The natural gas is injected at atmospheric pressure through a specially designed natural gas mixer where it is properly mixed with air. Natural gas then flows into the engine's combustion chamber and is ignited, to create the power required to drive the vehicle. Special solenoid valves prevent the gas from entering the engine when it is shut off.

How will NGVs help the U.S. meet legislation requirements?

- ◆ The Energy Policy Act (EPA) of 1992 requires alternative fuel providers and state fleets to begin purchasing 30 percent and 10 percent, respectively, of their new vehicle acquisitions to be powered by natural gas and other alternative fuels starting September 1996. With the federal fleet's increasing commitment to AFVs leading the way, NGVs are the vehicle of choice for the U.S. Postal Service and many Defense Department fleets. For example, the Postal Service runs 7,000 vehicles on natural gas.

The law includes other provisions which benefit NGVs:

- ◆ Tax incentives for purchasing NGVs and building stations
- ◆ Program for school districts to convert buses
- ◆ The Clean Air Act Amendments require centrally fueled fleets of 10 or more vehicles to begin purchasing alternative fuel vehicles (AFVs) in 22 cities by model year 1998. Vehicles required to be purchased range in weight from passenger cars and pick-up trucks to larger trucks up to 26,000 pounds gross vehicle weight. These vehicles must meet strict emission standards that will motivate clean fuel technologies. These standards are readily achievable by NGVs. In fact, in 1994 the California Air Resources Board certified, as surpassing the ultra low emission vehicle standard, Chrysler's mini van, the cleanest commercially vehicle now available on the road. Additionally, rigorous standards limiting particulate emissions from urban buses will help drive heavy duty engine technology to achieve new levels of cleanliness that will be advantageous for natural gas.
- ◆ The Environmental Protection Agency approved a petition by the Ozone Transport Commission which puts in place a low emission vehicle (LEV) program for the entire 13-state region, as provided under the Clean Air Act Amendments. While the states and the automobile industry are negotiating an alternative to the LEV program, most states in the region continue to support an advanced technology vehicle component, which includes NGVs.
- ◆ The Congestion Mitigation Air Quality (CMAQ) program established by the Intermodal Surface Transportation Efficiency Act of 1991 allocates money to states for use in their transportation/air quality plans. A primary focus of CMAQ funding is investment in air quality improvements, and NGV projects have been successful in receiving these funds.

What is the NGV industry's strategy?

- ◆ NGVs are ideal for fleet operations, and the industry is concentrating on high fuel use commercial fleets such as refuse haulers, public transit buses, airport shuttles and taxis, and over-the-road trucks. NGVs are here now, an indication that the industry has moved beyond the developmental stage into commercialization and expanded applications.
- ◆ U.S. states view the emerging NGV (and all alternative fuels) industry as an economic development opportunity. The states support combining the use of incentives and the implementation of EPA's fleet regulations to make the alternative fuel vehicle industry sustainable. The Department of Energy's Clean Cities program is currently operating in 62 areas across the United States. More than 1,200 stakeholders have signed agreements to increase the use of alternative fuel vehicles in their localities. The natural gas vehicle industry is the only alternative fuel that has a presence in all Clean Cities locations except Hawaii.

How can I find out more about NGVs?

- ◆ Contact your local natural gas utility or the Natural Gas Vehicle Coalition at 703/527-3022. Visit the NGVC's website at www.ngvc.org.

